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Is a common currency area feasible for East Asia?
A multivariate structural VAR approach

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Is a common currency area feasible for East Asia?

A multivariate structural VAR approach

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Abstract

In this paper the feasibility of forming a common currency area in East Asia is investigated. A three-variable SVAR model is employed to identify three types of shocks, i.e. global, regional, and domestic shocks. The empirical results do not provide strong support for forming a common currency area in this region because the symmetric "prevalent shock" cannot be defined. However, it is found that since the late 1990s the importance of asymmetric domestic shocks has declined while that of symmetric global and regional shocks has increased. Furthermore, East Asia is as symmetric as the Euro Area in terms of the correlation of global and regional shocks. The findings suggest that most East Asian economies have become symmetric in terms of economic shocks, and imply that a common currency area may become viable through deepening regional integration.

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1 Introduction

Before the 1997–1998 Asian financial crisis, most East Asian countries adopted a fixed exchange rate regime or a managed floating exchange rate regime that was a de facto US dollar peg. The experience of the 1997–1998 financial crisis made East Asian countries aware of the importance of keeping their currency stable to ensure sustainable and stable economic growth. At the same time, the launch of the Euro in 1999 has reawakened interest in the feasibility of forming a common currency area in East Asia.

Studies about the formation of a common currency area are led by the theory of optimum currency areas (OCA), i.e., the seminal works of Mundell (1961) and McKinnon (1963). According to the theory of OCA, there are benefits in forming a common currency area. One of them is the elimination of exchange-rate variability within the area, and another is the monetary efficiency gain from lower transaction costs. On the other hand, the major cost of forming such an area is the inability to pursue independent monetary policies and to use the exchange rate as an instrument of adjustment.

It is generally accepted that the symmetry of economic shocks is the crucial criterion when a country decides whether to join a common currency area or not. Mundell (1961) argues that countries facing symmetric economic shocks will be plausible candidates for a common currency area because it would allow the use of region-wide policies to stabilize economic fluctuations. Therefore, if economic shocks are symmetric across economies in East Asia, then the cost of forming a common currency area would be trivial. On the other hand, if economic shocks are highly idiosyncratic, it is not ideal to adopt a common currency because the asymmetric responses and adjustments would make region-wide monetary policies unable to stabilize economic fluctuations in the currency area and thus their costs would be large.

Several empirical studies investigate the symmetry of economic shocks using structural VAR (SVAR) models. The findings, however, are mixed. Some studies, such as Bayoumi and Eichengreen (1994), Zhang *et al*. (2004), and Huang and Guo (2006), find that only a few economies in the region are potential candidates for a common currency area, while others, such as Chow and Kim (2003) and Jeon and Zhang (2007), find that East Asian economies are not yet ready to form a common currency union. The latter are mainly based on the results of variance decomposition, a new analysis examining economic shocks. SVAR models employed in the above empirical studies are diverse. However, the benchmark framework is developed by Bayoumi and Eichengreen (1994).

Bayoumi and Eichengreen (1992, 1994) apply the aggregate demand–aggregate supply (AD–AS) model[1] to develop a SVAR model, and identify supply and demand shocks using a procedure proposed by Blanchard and Quah (1989). Bayoumi and Eichengreen (1994) focus on supply shocks

[1] They use the effects of permanent aggregate supply and demand shocks. The effects indicate that demand shocks, though permanent, affect output only temporarily while supply shocks have permanent effects on output and prices. Therefore, it is appropriate to employ the long-run restrictions developed by Blanchard and Quah (1989) to identify supply and demand shocks in the SVAR model.

because, given the underlying model, they are not affected by changes in stabilization policies and are more likely to be invariant with respect to alternative international monetary regimes. Therefore, supply shocks are more informative than demand shocks in investigating the economic structure within a region. If supply shocks are symmetric within a region, then the region would be a plausible candidate for a common currency area.

Chow and Kim (2003) argue that one difficulty of the Bayoumi–Eichengreen model is that it is unable to distinguish whether supply shocks are global, regional, or domestic. Because East Asian economies adopt export-oriented growth policies and intraregional trade has increased, it is reasonable that fluctuations in domestic output may be caused by those of trade partners. Hence, identifying these types of supply shocks would help examine the possibility of pursuing region-wide monetary policies because the prevalence of symmetric regional or domestic shocks would justify region-wide monetary policies.

Chow and Kim (2003) apply a three-variable model with global, regional, and domestic outputs to distinguish whether shocks are global, regional, or domestic. Their finding implies that East Asian economies are strongly influenced by country-specific shocks over the sample period from the 1970s to 1997. As Frankel and Rose (1998) argue, however, countries are likely to experience more similar shocks as trade increases, implying that economic shocks will become more highly correlated as the economic integration progresses. Hence, it is likely that all economies in this region would be affected by a common symmetric shock because in recent years, intraregional trade has been increasing and economic integration in this region has been progressing.[2]

This paper investigates whether or not East Asian economies are affected by a common symmetric shock and whether or not it is possible to pursue region-wide monetary policies by employing a model similar to Chow and Kim (2003) using recent data from the 1980s to 2006. During this period, intraregional trade and economic integration were increasing. We investigate changes in economic shocks caused by increases in intraregional trade and economic integration.

This paper examines the desirability of forming a common currency area in nine East Asian economies[3] by analyzing the symmetry of economic shocks. It also attempts to identify the "prevalent shock"—that is, the shock that is relatively more influential or dominant than the other shocks and common for most or all the member economies. The reason is, if all the member economies have the same type of dominant or relatively more influential shocks that are also positively correlated, it would be less costly to pursue a region-wide monetary policy to stabilize output fluctuations. A variance decomposition of forecast errors is applied to identify the prevalent shock. In measuring the symmetry of economic shocks, the correlations of and impulse responses to the shocks are examined. Given that European countries have formed a single currency area, the Euro Area[4] becomes a natural comparison.

[2] Huang and Guo (2006) point out that the intraregional trade linkages within East Asia have become stronger; on average, they increased from 42 percent in 1980, to 48 percent in 1990 and 51 percent in 2000. Grauew and Zhang (2006) also mention the importance of analyzing possible structural changes in East Asia

[3] The nine economies are China, Hong Kong, Japan, Korea, Taiwan, Indonesia, Malaysia, the Philippines and Thailand, respectively.

[4] Only nine countries of the Euro Area are analyzed. They are Austria, Belgium, Finland, France, Germany, Italy,

The empirical results do not provide strong support for forming a common currency area in this region because the "prevalent shock", which is symmetric, cannot be defined. However, it is found that since the late 1990s the importance of asymmetric domestic shocks has declined while that of symmetric global and regional shocks has increase. Furthermore, East Asia is as symmetric as the Euro Area in terms of the correlation of global and regional shocks. The findings suggest that most East Asian economies have become symmetric with regard to economic shocks, and imply that a common currency area may become viable through deepening regional integration..

The remainder of this paper is organized as follows. Section 2 presents a review of the literature on OCA including the theory and empirical studies employing SVAR. Section 3 describes the methodology and the data. Section 4 reports the empirical results. Section 5 summarizes the main findings.

2 Literature review

Forming an OCA means that member countries will lose their independent monetary policy, which is a key stabilization policy, and will be unable to use the exchange rate as an instrument of adjustment. If member countries face asymmetric shocks, it would be difficult to adopt a region-wide monetary policy. For instance, suppose an asymmetric demand shock shifts demand from member country A to member country B. This demand shock would cause unemployment in member country A and inflationary pressure in member country B. This situation would make it difficult for region-wide monetary policies to stabilize economic fluctuations in both of the countries. The reason is that it is necessary to increase the money supply to reduce unemployment in member country A but at the same time, the monetary expansion would further aggravate the inflationary pressure in member country B, which requires a contractionary monetary policy to relieve the inflationary pressure. For facilitating adjustments, Mundell (1961) emphasizes the importance of labor mobility within a common currency area. McKinnon (1963) argues that the gains from joining a common currency area are likely to be an increasing function of the openness of the member countries to intraregional trade because the openness increases the gains by reducing transaction costs. Kenen (1969) argues that diversified economies sharing the same industries are less likely to face asymmetric industry-specific shocks while economies specializing in sectors that respectively produce and use primary products may experience asymmetric industry-specific shocks.

Several empirical studies have investigated the feasibility of forming a common currency area in East Asia using SVAR models. The findings, however, are mixed. Bayoumi and Eichengreen (1994) employ a two-variable (output and price) SVAR model to identify supply and demand shocks using the procedure proposed by Blanchard and Quah (1989). They suggest two common currency areas for East Asia: a Northeast Asian bloc (Japan, Korea, and Taiwan) and a Southeast Asian bloc (Hong Kong, Indonesia, Malaysia, Singapore, and possibly Thailand). The correlations of supply shocks for

Netherlands, Portugal and Spain, respectively.

the two blocs are similar to those found in regional data for the United States. In addition, the size of shocks and the speed of adjustment of the two blocs appear to differ little from those of the United States.

The following two studies enlarge the Bayoumi–Eichengreen model. Zhang et al. (2004) employ a three-variable SVAR model to identify supply, demand, and monetary shocks. They find that the empirical results do not strongly support forming an optimum currency area in East Asia but do imply that some small subregions, such as some Asian NIEs and ASEAN countries, are potential candidates for forming a common currency area because their economic shocks are correlated and small, and these economies adjust to the shocks rapidly. Huang and Guo (2006) develop a four-variable SVAR model to distinguish external, supply, demand, and monetary shocks. They find that Japan does not satisfy the "shocking" criterion but recommend that Hong Kong, Indonesia, Korea, Malaysia, Singapore, and Thailand join the common currency area first.

The above empirical studies investigate economic shocks by examining the correlations of identified economic shocks and the impulse responses. The following studies also adopt variance decomposition to investigate the relative importance of identified shocks. Their findings are different from those stated above.

Chow and Kim (2003) employ a three-variable SVAR model to identify global, regional, and country-specific shocks. They use variance decomposition to measure which shock is relatively influential to the domestic output of East Asian economies. They find that the domestic output of East Asian economies are strongly affected by country-specific shocks while regional shocks are more influential in European countries that have joined the Economic and Monetary Union. They suggest that East Asian economies structurally differ from each other and thus a common currency peg in East Asia is likely to be more costly and difficult to sustain. Jeon and Zhang (2007) use an approach similar to that of Chow and Kim (2003), finding that Northeast Asian economies (China, Japan, Korea and Taiwan) are not suited to the formation of a common currency union presently; however, they can form an exchange rate union with a major currency basket consisting of the US dollar, the Euro, and the Japanese yen.

Based on the studies mentioned above, there is not a consensus yet on whether or not East Asian economies as a whole can form a common currency area, or on whether or not this region is ready to form a common currency area. Further investigation is required because as mentioned above, there may be some changes in economic shocks from increases in intraregional trade and the progress of economic integration. Therefore, this paper follows the study of Chow and Kim (2003) and tries to investigate whether the prevalent shock shifts from asymmetric shocks to symmetric shocks.

3 Econometric model and data

3.1 Methodology

Consider a three-variable model with global, regional, and domestic outputs: y_t^g, y_t^r, y_t^d. They are

related to three types of structural shocks as follows:

$$\begin{pmatrix} y_t^g \\ y_t^r \\ y_t^d \end{pmatrix} = \begin{pmatrix} C_{11}(L) & C_{12}(L) & C_{13}(L) \\ C_{21}(L) & C_{22}(L) & C_{23}(L) \\ C_{31}(L) & C_{32}(L) & C_{33}(L) \end{pmatrix} \times \begin{pmatrix} u_t^g \\ u_t^r \\ u_t^d \end{pmatrix},$$

where $u_t^g, u_t^r,$ and u_t^d denote global, regional, and domestic shocks, respectively.

Assume that structural shocks are uncorrelated and of unit variance: $Var(u_t) = I$. Structural shocks are unobserved. The following identifying restrictions are employed to recover them from the reduced-form residuals: (1) neither regional nor domestic shocks have long-run effects on global output; (2) domestic shocks have no long-run effects on regional output. These long-run restrictions are the same as those of Chow and Kim (2003), that is, generalizations of the small-economy assumptions that are often made in international economics. Thus, an economy is considered to be small in a region and the region is only a small part of the global economy. In terms of coefficient of the C(L) matrix, these restrictions amount to $C_{12}(1) = C_{13}(1) = C_{23}(1) = 0$ where $C_{ij}(1) = c_{ij}^0 + c_{ij}^1 L + c_{ij}^2 L^2 + \cdots$. The estimation of a model with these identifying restrictions is well known and hence omitted.

According to Chow and Kim (2003), domestic output is subject to three types of shocks, i.e., global, regional, and domestic shocks. The definition of the three types of shocks is as follows. Global shocks influence economies both inside and outside the regional boundary. Regional shocks are common to the economies within the region. For instance, the 1997–1998 Asian financial crisis may constitute a regional shock for East Asia. Domestic shocks are unique to a particular economy. Under the identifying restrictions, those shocks may be either from aggregate demand shocks that are associated with monetary or fiscal policies, or from supply shocks. For East Asian economies, the United States represents the global economy; the regional economy is a weighted average of East Asian economies.[5] For the Euro Area, the United States also represents the global economy; the regional economy is a weighted average of the countries in the Euro Area.

The importance of prevalent regional shocks is that such a shock within the region would constitute a prima facie case in favor of a common currency area because region-wide monetary policies would be pursued to stabilize economic fluctuations for the economies in this region. If, on the other hand, domestic shocks are prevalent and uncorrelated (asymmetric) across economies, a common currency area would be difficult to sustain because it is costly to pursue a region-wide policy. Furthermore, global shocks that are symmetric across economies in the region would reduce the potential disruptions caused by global shocks under bilateral fixed exchange rates and allow flexible external exchange rates to correct the economic imbalance between a common currency area and countries outside the area.

Although the above model is similar to Chow and Kim (2003), there are still some differences. First, as mentioned in the introduction, the sample period in this paper is extended to include more

[5] See Section 3.2 for details.

recent years, which makes it possible to investigate the shift of the prevalent shock. Second, whereas quarterly output data are represented by industrial production in Chow and Kim's model, in our model they are represented by real GDP, which includes information about broader economic activities. Third, while Chow and Kim (2003) use Japanese output as a proxy for regional output, this paper uses a weighted average of domestic outputs as a proxy for regional output. Fourth, this paper includes more economies in the analysis. The economies analyzed by Chow and Kim (2003) are Hong Kong, Korea, Taiwan, Indonesia, Malaysia, the Philippines, and Singapore. However, we also include China, Japan, and Thailand for the analysis.[6] In addition, the European countries under analysis in our model are different from those of Chow and Kim's model. Because our concern is to form a common currency area in East Asia, we do not elaborate on the differences in European countries.

3.2 Data description

In this paper, output is represented by the annual real GDP growth rate. Quarterly nominal GDP and GDP deflator data are obtained from IFS CD-ROM (May 2008) for most economies. Quarterly real GDP data of Taiwan are obtained from the Web site of the Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan. As for the quarterly real GDP data of China, Indonesia, Malaysia, the Philippines, and Thailand, we use the estimates obtained from Tilak Abeysinghe's homepage.[7]

The regional variable of each economy is a weighted average of eight economies, indicating that the weighted average excludes the economy that represents the domestic variable in each model. Weights are based on constant US dollar GDP for the year 2000 and the data are obtained from World Development Indicators 2007.

The time series starts at 1980Q1 and ends at 2006Q4 for all economies in East Asia.[8] For ease of comparison, the same methodology is employed to identify economic shocks for the nine Euro Area countries. The time series for the Euro Area is from 1981Q1 to 2007Q1.[9] To investigate the shift of the prevalent shock, the sample period is split into two subperiods. The first subperiod is from 1980Q1 to 1996Q4for East Asia and from 1981Q1 to 1998Q4 for the Euro Area. The second one is from 1999Q1 to 2006Q4[10] for East Asia and 1999Q1 to 2007Q1 for the Euro Area.

Two lags are used for the whole period and one in the subperiods for the two regions because the Schwarz Information Criterion (SIC) indicates that most of the models have an optimal lag length of either one or two. The nonstationarity of the data is ignored and the models are estimated in levels without unit root tests being conducted. This is one option that Hamilton (1994) recommends. See Hamilton (1994) for details.

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[6] Singapore is not included because insufficient quarterly data are available.
[7] http://courses.nus.edu.sg/course/ecstabey/Tilak.html
[8] Because quarterly GDP data for the Philippines is only available until 2006Q4, this paper does not extend the period to 2007. Quarterly data for 1979 are used to calculate the quarterly growth rate of 1980.
[9] Because quarterly data for Belgium and Italy start from 1980Q1, the time series of real GDP growth starts at 1981Q1. Quarterly data for 1980 are used to calculate the quarterly growth rate for 1981.
[10] An additional subperiod 1995Q1 – 2006Q4 will be examined for East Asia to investigate whether our model is capable of capturing regional shocks and how results are affected by the inclusion of the crisis period.

Another important thing before estimation is to examine whether the models are stable. Models are stable if all roots have modulus less than one. If they are not stable, certain results (such as impulse response standard errors) are not valid. See Lutkepohl (1991) for details. Therefore, the VAR autoregressive roots of each model are investigated and it is confirmed that all the models satisfy the stability condition.

4 Empirical results

4.1 Variance decomposition of forecast errors

The main cost of joining a common currency area is the loss of independent monetary policies. The cost would be large when economic shocks are asymmetric within the region. However, if one type of shock is negatively correlated, but can only explain a small amount of the variation in domestic output, then the cost generated by this shock is likely to be trivial. On the other hand, if one type of shock is positively correlated and influential (or say important) in explaining variation in output commonly within the region, the adoption of a region-wide monetary policy can stabilize output fluctuations for all the member economies with less cost.

In assessing which shock is most influential and whether this shock is common for each region, we compute the variance decomposition of domestic output, which provides information about the relative importance of each shock in affecting the variables in the VAR. The results are reported in Tables 1 and 2. The columns give the percentage of the forecast variance associated with each shock, with each row summing to 100%.

4.1.1 Whole period

Table 1 reports the variance decomposition of the forecast errors of domestic output at the four- and 20-quarter forecast horizons for East Asia. As for China, global shocks are dominant and explain over 57% of output variation. Regional shocks are dominant and explain over 66% of output variation for Thailand. Domestic shocks are dominant and explain over 60% of output variation for Hong Kong, Japan, Indonesia, Malaysia, and the Philippines. For Korea and Taiwan, both regional and domestic shocks are influential and explain over 30% of output variation.

Table 2 reports the variance decomposition of forecast errors of domestic output at the four- and 20-quarter forecast horizons for the Euro Area. Domestic shocks are dominant or relatively influential, and explain over 54% for Austria, Finland, France, Germany, and Italy while regional shocks are dominant and explain over 61% for Belgium, Portugal, and Spain. As for Netherlands, regional shocks are relatively influential. The results indicate that East Asia is more influenced by domestic shocks than the Euro Area for the whole period.

(insert Tables 1 and 2 here)

4.1.2 Subperiods

In the subperiods, we observe a shift of the prevalent shock from Table 1. In the second subperiod 1995Q1 – 2006Q4, dominant shocks shift from domestic shocks to regional shocks for Korea, Indonesia, Malaysia, the Philippines, and Thailand. For China, Hong Kong, and Japan, both regional and domestic shocks are influential in the second subperiod, and it is obvious that in comparison with the first subperiod, regional shocks become more important than domestic ones. As for Taiwan, regional shocks become more important while domestic ones become less important. Since the results may be affected by the inclusion of the crisis period, we then examine how the results change after the crisis period is excluded. The second subperiod 1999Q1 – 2006Q4 in Table 1 provides different results.[11] In the latter second subperiod, no obvious shift of the prevalent shock is observed. However, the postcrisis period still bears a resemblance—that is, the importance of domestic shocks, which are asymmetric, declines for most economies except for China, Japan and Indonesia. Another noteworthy change is that the importance of regional shocks does increase for several economies. Furthermore, the importance of global shocks increases for Hong Kong, Japan, Korea, Taiwan, Malaysia, the Philippines and Thailand.

Those changes in shocks may have resulted from the regional economic integration and increases in intraregional trade. As Huang and Guo (2006) point out, the intraregional trade linkage for East Asia has become stronger; on average, it increased from 42 percent in 1980, to 48 percent in 1990, and to 51 percent in 2000, respectively. Therefore, the results confirm the viewpoint of Frankel and Rose (1998) that countries are likely to experience more similar shocks as trade increases. In addition, the results of the first subperiod for the East Asian economies confirm the finding of Chow and Kim (2003) that domestic shocks are dominant for East Asian economies.

As for the Euro Area, the second subperiod in Table 2 shows that regional shocks turn out as anticipated except for Belgium and Italy. For Austria, France, Netherlands, Spain and Portugal, dominant shocks shift from domestic shocks to regional shocks in the second subperiod. However, domestic shocks increase for Belgium in the second subperiod. Furthermore, global shocks become relatively influential for Germany in the second subperiod. Overall, the importance of asymmetric domestic shocks does decline in the second subperiod (the Euro era) for most countries in the Euro Area. Those changes again affirm Frankel and Rose (1998)'s viewpoint stated above.

To sum up, the variance decomposition analysis shows that in East Asia the prevalent shock does not shift from domestic shocks to regional shocks based on the results in the postcrisis period. However, in comparison with the Euro Area, East Asia shows a similar pattern of changes in shocks—that is, the importance of regional shocks increases and that of domestic shocks decreases.

4.2 Correlation analysis

A natural way of examining the relevant issue of symmetry of shocks across the member economies is to compute the correlation coefficients of the identified economic shocks. To assess the symmetry and asymmetry of the shocks, we assume that if the correlation is positive, the shocks are

[11] Albeit the results between the two second subperiod are not consistent, our weighted regional variable seems to serve as a plausible proxy because it is capable of capturing regional shocks , the 1997-98 Asian financial crisis, when we include the crisis period in our estimation.

categorized as symmetric. On the other hand, if the correlation is small, negative or zero, the shock would be categorized as asymmetric.[12] The correlation coefficients of the three identified shocks for the East Asian economies and the Euro Area countries are reported in Tables 3 to 8.

4.2.1 Correlations of global shocks

As shown in Table 3, in each sample period, shock for the East Asian economies exhibit positive and high correlations, except the shocks in China and Japan that exhibit somewhat smaller correlations in the whole period and the first subperiod. The reason for the high correlations across the economies may be that East Asian economies have adopted export-oriented growth strategies and the United States, representing the global economy, has been an important trade partner for those economies. The results in Table 4 show that the correlations of global supply shocks in the Euro Area in each sample period are positive and high, except the shocks in Germany that show somewhat smaller correlations in the first period. In comparison with the Euro Area, global shocks in East Asia are as symmetric as those of the Euro Area. The higher the correlation of the global shock, the smaller the cost associated with the loss of flexible exchange rates. The reason is that under the regime of a common currency, the potential disruptions caused by global shocks under bilateral fixed exchange rates across member economies are reduced, if not eliminated.

(insert Tables 3 and 4 here)

4.2.2 Correlations of regional shocks

As shown in Table 5, the shocks in East Asia exhibit positive and relatively high correlations in the whole period except for shocks in Japan. There is a notable change between the two subperiods. Shocks in Japan correlate negatively with the rest of the region in the first subperiod but correlate positively with the rest of the region in the second subperiod.[13] One possible explanation for the change may be that China—the most important variable in computing the regional variable of Japan—became an important trading partner of Japan in recent years. As Jeon and Zhang (2007) point out, China was the second largest trading partner of Japan after the United States and China's share in Japan's total trade grew from four percent in 1991 to 16 percent in 2003, implying that such an increase in intraregional trade may result in the integration of Japan with East Asia and that the regional shocks that Japan face correlate positively with those of the rest of the region. For the Euro Area, the results in Table 6 show that all the European countries exhibit positive correlations in each sample period.

In sum, regarding the symmetry of regional shocks, East Asia is as good as the Euro Area, which has proceeded to monetary integration and has a long history of regional economic integration.

(insert Tables 5 and 6 here)

[12] The correlation coefficients are categorized without testing whether they are statistically significant, because in this paper we simply examine the relationship among East Asian economies during a selected period and investigate the structural change after the late 1990s.

[13] Shocks in Thailand correlate highly and positively with the rest of the region in the first subperiod but its correlations with the other economies become relatively smaller in the second subperiod.

4.2.3 Correlations of domestic shocks

From Tables 7 and 8, we find that in each sub period shocks in both East Asia and the Euro Area exhibit smaller positive correlations or negative correlations. Both regions do not exhibit much change in the second subperiod. Shocks in Japan correlate even more negatively with the rest of the region. Although the correlations of domestic shocks are negative or small and positive in comparison with global and regional shocks, this asymmetry may not be a grave problem because the importance of domestic shocks declines in the second subperiod for most East Asian economies as analyzed in the variance decomposition.

(insert Tables 7 and 8 here)

4.3 Impulse response analysis

Impulse response functions trace the effects of a shock to endogenous variables in the VAR model. Therefore, impulse response analysis is used to investigate the adjustment processes of output in response to different shocks. If the adjustment processes of these economies to different types of shocks exhibit the same direction and pattern, then a region-wide monetary policy may be introduced to all economies with less cost because those shocks affect domestic outputs in a symmetric way. Figures 1 to 2 measure the dynamic effect of a one standard deviation structural shock on domestic output over a 40-quarter period for each East Asian economy. In this analysis, we focus on global and regional shocks given that their importance increased during the postcrisis period.

From Figure 1, we can observe that the path of the response in the first subperiod is diverse. It is obvious that the long-run response of domestic output provoked by regional shocks is negative for most East Asian economies. Moreover, Figure 1 also shows that the long-run response of domestic output provoked by global shocks is negative for several East Asian economies. In spite of the negative long-run responses in the first subperiod, some changes emerge in the second subperiod. As shown in Figure 2, except for Korea and Malaysia, the East Asian economies exhibit similar path of responses—that is, regional shocks provoke a positive long-run response of domestic output—even though the magnitude of responses vary. Furthermore, the long-run response of domestic output provoked by global shocks is positive for all the East Asian economies, although the magnitude of responses vary. The changes imply that the adjustment process of output to global and regional shocks becomes symmetric in this region.

(insert Figures 1 to 2 here)

5 Conclusion

In this paper, the feasibility of forming a common currency area in East Asia is investigated by analyzing symmetries of shocks and the possibility of adopting region-wide monetary policies is examined. A three-variable SVAR model is employed to measure the relative importance and

symmetry of three types of shocks based on the method developed by Chow and Kim (2003). The main difference of this study is that the sample period covers the period after 1997, aiming to investigate the changes of economic shocks caused by regional economic integration in recent years.[14]

The result of the variance decomposition of the first subperiod is similar to the finding of Chow and Kim (2003) that shows that domestic shocks are dominant for almost all the East Asian economies. In the postcrisis period, the prevalent shock cannot be defined, indicating that pursuing a region-wide monetary policy may result in undesirable cost. However, it is found that domestic shocks, which are asymmetric, have become less important for most economies, and that the importance of regional and global shocks does increase for several economies. Furthermore, in terms of global and regional shocks, this region exhibits positive correlations and similar responses of domestic output in the second subperiod. The findings confirm the viewpoint of Frankel and Rose (1998), implying that East Asia has become more symmetric in recent years from the economic perspective. Although our findings do not provide strong support for forming a common currency area in the region at the current stage, increasing intraregional trade, financial and investment interdependence, as Sanchez (2005) argues, could reinforce each other over time, leading to a different consideration for the degree of maturity of the conditions for deeper economic integration and in particular a monetary union.

Some caveats remain. First, the three-variable model consisting of three types of output represented by real GDP growth rate may disregard the disturbances from price levels. Further research could attempt to develop appropriate identifying restrictions to allow a larger model that more finely differentiates disturbances into demand shocks and supply shocks to avoid this problem. Second, we attempt to investigate whether it is possible to pursue a region-wide monetary policy in East Asia based on the shocking criterion. But how, in practice, do monetary authorities make their policies? Is the reaction of each economy's monetary policy to economic shocks the same? Further research could try to examine these questions.

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[14] Shocks that are influential to domestic output are likely to change as the economic structure changes. For instance, the influential shock of each economy might be changed by environmental problems such as the global warming. It is possible that different structural changes would occur in the years to come. Despite this possibility, our findings are valid because the change in economic structures generated by trade is irreversible and the importance of regional shocks might be reinforced by the increasing intraregional trade. To track the possible change, more research is warranted using more recent data.

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Table 1. Variance decomposition of domestic output: East Asia

		Whole period			First subperiod			Second subperiod					
		1980Q1–2006Q4			1980Q1–1996Q4			1995Q1–2006Q4			1999Q1–2006Q4		
.	Quarters	u^g	u^r	u^d	u^g	u^r	u^d	u^g	u^r	u^d	u^g	u^r	u^d
China	4	59	1	40	45	1	54	1	51	48	6	43	51
	20	57	1	42	46	10	44	4	55	41	10	44	45
Hong Kong	4	8	24	68	2	3	95	10	46	44	29	33	38
	20	11	28	61	4	4	92	7	62	31	48	24	28
Japan	4	16	10	74	31	14	55	1	54	46	29	11	60
	20	12	11	78	27	16	57	1	66	33	45	9	45
Korea	4	2	52	47	4	17	79	1	78	21	34	32	33
	20	8	48	44	5	16	78	2	70	28	31	44	25
Taiwan	4	27	30	43	27	6	67	25	48	27	36	54	11
	20	27	32	41	32	8	60	38	40	23	38	51	11
Indonesia	4	5	12	84	4	16	79	23	49	28	5	8	88
	20	10	22	68	5	22	73	21	62	17	15	7	78
Malaysia	4	3	6	91	3	6	91	0.1	73	26	55	16	30
	20	11	7	82	4	14	82	0.4	80	20	59	16	25
Philippines	4	5	4	91	7	1	92	2	64	33	29	47	24
	20	8	5	86	21	1	78	2	74	24	38	41	21
Thailand	4	7	73	19	3	4	93	4	91	5	42	24	34
	20	13	66	20	5	8	87	25	70	5	42	24	34

Note: u^g, u^r and u^d denote global, regional, and domestic shocks, respectively.

Table 2. Variance decomposition of domestic output: Euro Area

.	Quarters	Whole period 1981Q1–2007Q1			First subperiod 1981Q1–1998Q4			Second subperiod 1999Q1–2007Q1		
		u^g	u^r	u^d	u^g	u^r	u^d	u^g	u^r	u^d
Austria	4	5	41	54	14	40	47	13	52	36
	20	6	46	48	15	45	40	30	45	25
Belgium	4	3	61	35	7	63	31	11	31	57
	20	6	61	34	8	65	27	24	34	42
Finland	4	4	41	55	4	27	69	26	23	51
	20	12	26	62	16	19	64	39	24	37
France	4	4	38	58	15	18	67	9	70	21
	20	4	39	57	13	24	63	39	50	11
Germany	4	5	20	75	7	6	87	51	9	39
	20	5	27	68	7	16	77	46	15	39
Italy	4	6	19	75	1	48	51	12	33	55
	20	11	26	63	9	49	42	22	46	32
Netherlands	4	23	41	36	12	35	53	16	79	5
	20	29	42	29	26	35	39	45	50	5
Portugal	4	6	70	23	17	29	54	9	77	15
	20	7	70	23	19	36	45	13	65	22
Spain	4	1	80	20	2	73	24	6	70	24
	20	1	75	23	2	77	21	31	53	16

Note: u^g, u^r and u^d denote global, regional, and domestic shocks, respectively.

Table 3. Correlations of global shocks: East Asia

Panel A Whole period

	CH	HK	JP	KR	TW	ID	MA	PH	TH
China	1.00								
Hong Kong	0.65	1.00							
Japan	0.86	0.76	1.00						
Korea	0.65	0.99	0.78	1.00					
Taiwan	0.63	0.91	0.79	0.93	1.00				
Indonesia	0.58	0.96	0.66	0.96	0.91	1.00			
Malaysia	0.63	0.98	0.73	0.99	0.93	0.97	1.00		
Philippines	0.65	0.99	0.77	1.00	0.93	0.96	0.99	1.00	
Thailand	0.43	0.88	0.53	0.88	0.87	0.93	0.89	0.88	1.00

Panel B First subperiod: 1980Q1–1996Q4

	CH	HK	JP	KR	TW	ID	MA	PH	TH
China	1.00								
Hong Kong	0.64	1.00							
Japan	0.86	0.72	1.00						
Korea	0.62	0.97	0.80	1.00					
Taiwan	0.64	0.98	0.78	0.99	1.00				
Indonesia	0.51	0.89	0.57	0.87	0.86	1.00			
Malaysia	0.66	0.92	0.71	0.91	0.92	0.82	1.00		
Philippines	0.61	0.96	0.73	0.95	0.96	0.85	0.90	1.00	
Thailand	0.62	0.95	0.72	0.95	0.96	0.83	0.91	0.94	1.00

Panel C Second subperiod: 1999Q1–2006Q4

	CH	HK	JP	KR	TW	ID	MA	PH	TH
China	1.00								
Hong Kong	0.95	1.00							
Japan	0.96	0.87	1.00						
Korea	0.98	0.93	0.98	1.00					
Taiwan	0.96	0.89	0.97	0.97	1.00				
Indonesia	0.99	0.96	0.95	0.98	0.97	1.00			
Malaysia	0.93	0.88	0.98	0.98	0.95	0.94	1.00		
Philippines	0.96	0.91	0.97	0.98	0.97	0.97	0.97	1.00	
Thailand	0.82	0.76	0.91	0.90	0.82	0.83	0.93	0.87	1.00

Table 4. Correlations of Global Shocks: Euro Area

Panel A Whole period

	AU	BE	FI	FR	GE	IT	NE	PO	SP
Austria	1.00								
Belgium	0.96	1.00							
Finland	0.95	0.98	1.00						
France	0.92	0.95	0.94	1.00					
Germany	0.91	0.93	0.96	0.86	1.00				
Italy	0.86	0.92	0.92	0.88	0.93	1.00			
Netherlands	0.85	0.88	0.87	0.87	0.84	0.79	1.00		
Portugal	0.94	0.98	0.97	0.95	0.92	0.93	0.88	1.00	
Spain	0.89	0.93	0.95	0.89	0.95	0.87	0.81	0.91	1.00

Panel B First subperiod: 1981Q1–1998Q4

	AU	BE	FI	FR	GE	IT	NE	PO	SP
Austria	1.00								
Belgium	0.90	1.00							
Finland	0.90	0.94	1.00						
France	0.88	0.88	0.93	1.00					
Germany	0.88	0.93	0.98	0.90	1.00				
Italy	0.86	0.92	0.97	0.91	0.98	1.00			
Netherlands	0.86	0.87	0.93	0.91	0.93	0.90	1.00		
Portugal	0.89	0.92	0.98	0.94	0.96	0.97	0.93	1.00	
Spain	0.91	0.94	0.99	0.94	0.99	0.97	0.94	0.98	1.00

Panel C Second subperiod: 1999Q1–2007Q1

	AU	BE	FI	FR	GE	IT	NE	PO	SP
Austria	1.00								
Belgium	0.84	1.00							
Finland	0.97	0.79	1.00						
France	0.69	0.56	0.71	1.00					
Germany	0.48	0.55	0.49	0.82	1.00				
Italy	0.95	0.75	0.96	0.79	0.53	1.00			
Netherlands	0.96	0.79	0.95	0.69	0.45	0.92	1.00		
Portugal	0.98	0.79	0.98	0.71	0.49	0.95	0.97	1.00	
Spain	0.70	0.62	0.72	0.78	0.76	0.79	0.65	0.67	1.00

Table 5. Correlations of regional shocks: East Asia

Panel A Whole period

	CH	HK	JP	KR	TW	ID	MA	PH	TH
China	1.00								
Hong Kong	0.98	1.00							
Japan	0.44	0.54	1.00						
Korea	0.97	0.97	0.50	1.00					
Taiwan	0.87	0.91	0.65	0.88	1.00				
Indonesia	0.95	0.98	0.50	0.96	0.88	1.00			
Malaysia	0.95	0.97	0.48	0.96	0.87	0.99	1.00		
Philippines	0.96	0.96	0.39	0.93	0.84	0.95	0.96	1.00	
Thailand	0.85	0.87	0.50	0.86	0.75	0.85	0.87	0.87	1.00

Panel B First subperiod: 1980Q1–1996Q4

	CH	HK	JP	KR	TW	ID	MA	PH	TH
China	1.00								
Hong Kong	0.86	1.00							
Japan	-0.54	-0.11	1.00						
Korea	0.83	0.94	-0.07	1.00					
Taiwan	0.79	0.92	-0.05	0.87	1.00				
Indonesia	0.73	0.93	-0.07	0.88	0.83	1.00			
Malaysia	0.79	0.99	-0.05	0.92	0.89	0.95	1.00		
Philippines	0.85	0.99	-0.12	0.93	0.91	0.94	0.99	1.00	
Thailand	0.88	1.00	-0.16	0.93	0.91	0.93	0.98	0.99	1.00

Panel C Second subperiod: 1999Q1–2006Q4

	CH	HK	JP	KR	TW	ID	MA	PH	TH
China	1.00								
Hong Kong	0.97	1.00							
Japan	0.41	0.42	1.00						
Korea	0.96	0.97	0.30	1.00					
Taiwan	0.85	0.88	0.49	0.86	1.00				
Indonesia	0.93	0.97	0.34	0.96	0.81	1.00			
Malaysia	0.82	0.89	0.39	0.90	0.76	0.92	1.00		
Philippines	0.83	0.88	0.39	0.84	0.80	0.87	0.82	1.00	
Thailand	0.80	0.84	0.32	0.85	0.61	0.88	0.86	0.73	1.00

Table 6. Correlations of regional shocks: Euro Area

Panel A Whole period

	AU	BE	FI	FR	GE	IT	NE	PO	SP
Austria	1.00								
Belgium	0.96	1.00							
Finland	0.83	0.85	1.00						
France	0.95	0.98	0.84	1.00					
Germany	0.72	0.72	0.69	0.74	1.00				
Italy	0.83	0.86	0.69	0.86	0.58	1.00			
Netherlands	0.95	0.98	0.85	0.98	0.77	0.86	1.00		
Portugal	0.71	0.72	0.63	0.70	0.65	0.74	0.70	1.00	
Spain	0.75	0.77	0.63	0.78	0.79	0.75	0.78	0.73	1.00

Panel B First subperiod: 1981Q1–1998Q4

	AU	BE	FI	FR	GE	IT	NE	PO	SP
Austria	1.00								
Belgium	1.00	1.00							
Finland	0.87	0.88	1.00						
France	0.94	0.94	0.84	1.00					
Germany	0.63	0.63	0.66	0.52	1.00				
Italy	0.98	0.98	0.89	0.94	0.66	1.00			
Netherlands	0.98	0.98	0.90	0.93	0.64	0.99	1.00		
Portugal	0.96	0.96	0.87	0.90	0.65	0.96	0.97	1.00	
Spain	0.84	0.84	0.77	0.83	0.72	0.84	0.85	0.87	1.00

Panel C Second subperiod: 1999Q1–2007Q1

	AU	BE	FI	FR	GE	IT	NE	PO	SP
Austria	1.00								
Belgium	0.93	1.00							
Finland	0.86	0.80	1.00						
France	0.93	0.92	0.85	1.00					
Germany	0.69	0.51	0.64	0.72	1.00				
Italy	0.53	0.52	0.70	0.59	0.44	1.00			
Netherlands	0.79	0.76	0.76	0.74	0.47	0.40	1.00		
Portugal	0.41	0.42	0.53	0.48	0.46	0.52	0.40	1.00	
Spain	0.67	0.63	0.81	0.75	0.75	0.76	0.43	0.65	1.00

Table 7. Correlations of domestic shocks: East Asia

Panel A Whole period

	CH	HK	JP	KR	TW	ID	MA	PH	TH
China	1.00								
Hong Kong	–0.14	1.00							
Japan	–0.19	0.10	1.00						
Korea	–0.37	0.25	–0.47	1.00					
Taiwan	0.35	0.33	0.15	–0.12	1.00				
Indonesia	–0.47	0.34	–0.04	0.55	–0.16	1.00			
Malaysia	–0.53	0.00	0.23	0.28	–0.16	0.44	1.00		
Philippines	0.36	0.20	0.38	–0.18	0.34	–0.33	–0.35	1.00	
Thailand	–0.51	0.16	–0.36	0.53	–0.29	0.66	0.26	–0.55	1.00

Panel B First subperiod: 1980Q1–1996Q4

	CH	HK	JP	KR	TW	ID	MA	PH	TH
China	1.00								
Hong Kong	-0.06	1.00							
Japan	0.53	0.09	1.00						
Korea	-0.16	0.22	-0.17	1.00					
Taiwan	-0.16	0.42	-0.30	0.38	1.00				
Indonesia	-0.06	0.27	0.40	-0.21	0.01	1.00			
Malaysia	-0.30	0.02	0.14	-0.01	-0.05	0.27	1.00		
Philippines	0.05	0.11	0.04	-0.06	-0.01	0.03	0.01	1.00	
Thailand	-0.16	-0.14	0.01	0.02	-0.01	0.06	0.31	-0.07	1.00

Panel C Second subperiod: 1999Q1–2006Q4

	CH	HK	JP	KR	TW	ID	MA	PH	TH
China	1.00								
Hong Kong	0.14	1.00							
Japan	-0.23	-0.26	1.00						
Korea	-0.11	0.05	0.02	1.00					
Taiwan	0.05	0.26	-0.55	0.11	1.00				
Indonesia	-0.17	0.20	-0.19	-0.44	-0.01	1.00			
Malaysia	-0.19	0.11	-0.52	0.16	0.51	0.22	1.00		
Philippines	0.00	0.29	-0.55	-0.15	0.52	0.29	0.45	1.00	
Thailand	0.02	0.04	-0.42	0.01	0.22	0.08	0.51	0.29	1.00

Table 8. Correlations of domestic shocks: Euro Area

Panel A Whole period

	AU	BE	FI	FR	GE	IT	NE	PO	SP
Austria	1.00								
Belgium	–0.27	1.00							
Finland	–0.07	0.16	1.00						
France	–0.13	0.16	–0.02	1.00					
Germany	0.03	–0.31	–0.49	–0.24	1.00				
Italy	–0.16	0.11	–0.04	–0.06	–0.12	1.00			
Netherlands	0.31	–0.15	–0.01	–0.29	–0.14	–0.02	1.00		
Portugal	–0.00	–0.02	0.23	0.18	–0.49	–0.50	–0.02	1.00	
Spain	–0.06	0.18	0.32	–0.08	–0.70	–0.26	0.07	0.53	1.00

Panel B First subperiod: 1981Q1–1998Q4

	AU	BE	FI	FR	GE	IT	NE	PO	SP
Austria	1.00								
Belgium	0.67	1.00							
Finland	-0.12	-0.01	1.00						
France	-0.27	-0.14	-0.07	1.00					
Germany	0.02	-0.17	-0.53	0.00	1.00				
Italy	-0.25	-0.32	0.14	-0.00	-0.41	1.00			
Netherlands	0.35	0.04	-0.03	-0.31	-0.00	-0.09	1.00		
Portugal	0.02	0.21	0.10	0.16	-0.23	-0.33	-0.14	1.00	
Spain	-0.11	0.04	0.34	-0.20	-0.60	-0.02	-0.06	0.40	1.00

Panel C Second subperiod: 1999Q1–2007Q1

	AU	BE	FI	FR	GE	IT	NE	PO	SP
Austria	1.00								
Belgium	-0.06	1.00							
Finland	0.30	0.09	1.00						
France	-0.25	0.10	-0.26	1.00					
Germany	0.13	-0.20	0.40	-0.71	1.00				
Italy	-0.08	0.26	0.44	-0.20	0.48	1.00			
Netherlands	0.05	-0.25	-0.31	-0.16	-0.11	-0.46	1.00		
Portugal	-0.13	-0.43	-0.61	0.24	-0.51	-0.70	0.52	1.00	
Spain	-0.22	0.03	-0.62	0.63	-0.84	-0.65	0.22	0.61	1.00

Figure 1. Accumulated response of domestic output to a one standard deviation shock (1980Q1–1996Q4)

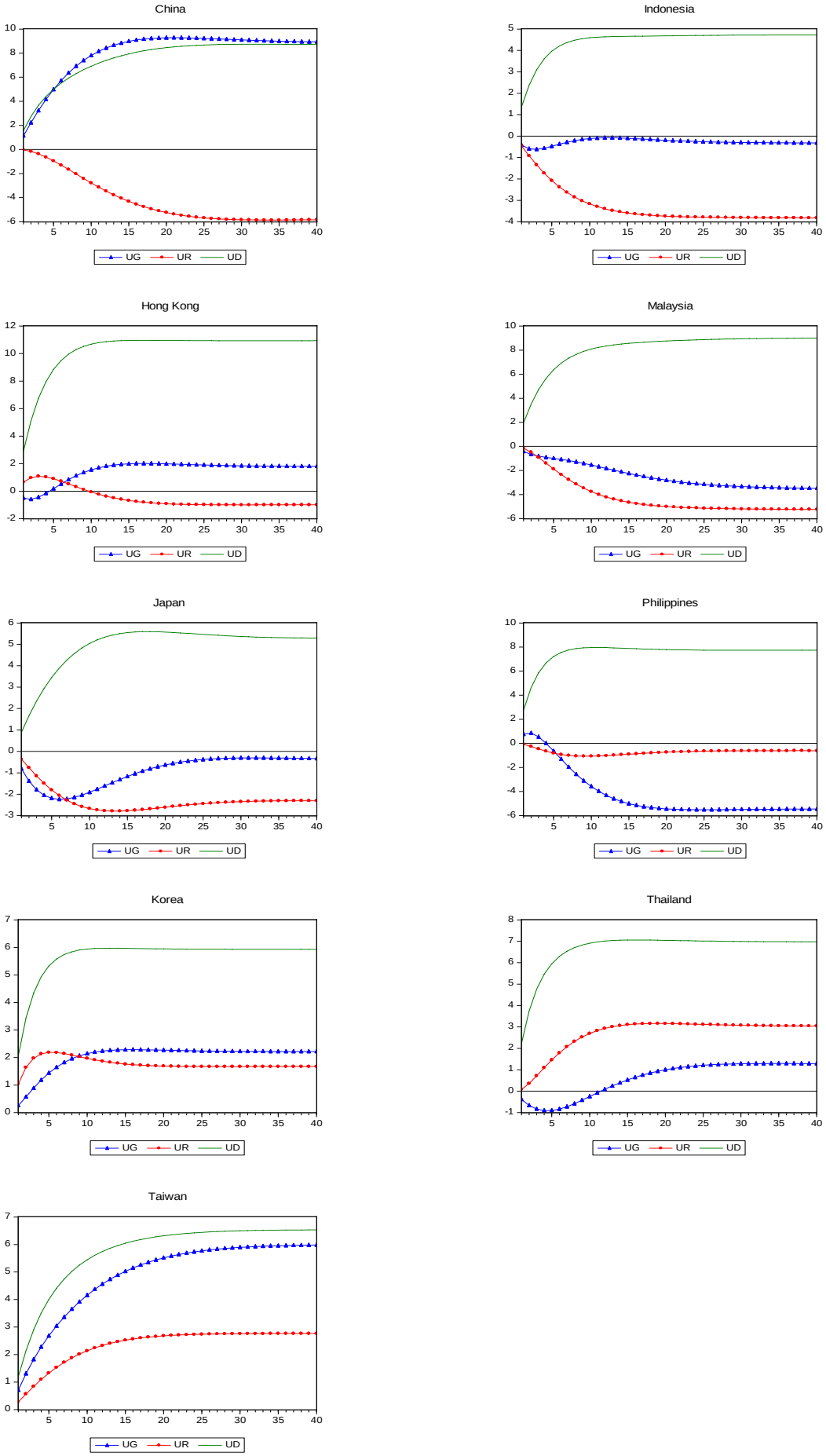

Figure 2. Accumulated response of domestic output to a one standard deviation shock (1999Q1–2006Q4)